4.3 KENNEDY CREEK SIPHON

4.3.1 Structure Overview

The Kennedy Creek siphon passes the canal flow beneath Kennedy Creek (Figure 4.0) through a concrete conduit approximately 200 feet long. The conduit has a 5-foot radius circular top and a rectangular bottom section. Interior height is 9.25 feet and the bottom width is 8.5 feet. There is a concrete transition structure and headwall at each end of the siphon with grouted rip rap that extends about 20 feet beyond the concrete transition (Figure 4.3.1). Training dikes have been constructed upstream on Kennedy Creek above the siphon to control and direct the stream flow to the passage point above the siphon. Kennedy Creek is a major stream drainage atop an active alluvial fan and has the propensity for channel migration during flood flows.

The upstream side of the siphon has a chain link fence around the top of the structure and along the sides of the transition. A floating boom has been placed in the channel upstream of the transition structure as a safety measure.

4.3.2 Existing Conditions and Deficiencies

Inlet Transition Structure and Headwall.

The inlet to the siphon appears to be in generally poor to marginal condition (Figure 4.3.1). There are areas of deteriorated concrete with pockets and holes near the winter low water line. Some reinforcing steel is exposed. The headwall is cracked in several places (Figure 4.3.2).

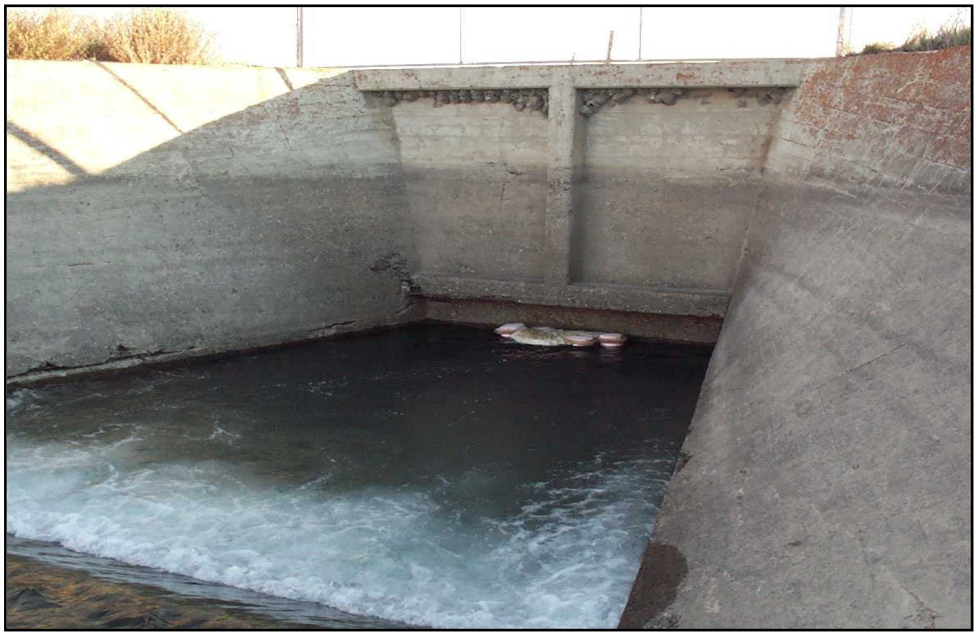

Figure 4.3.1 Inlet section (south side) of Kennedy Creek Siphon (10/13/04).

Siphon.

The siphon was full of water and could not be fully inspected. The siphon was dewatered in 1999 by BOR staff and found to be in relatively good condition. The top of the siphon structure was reported to be exposed in Kennedy Creek during a field inspection in 2002. The top was not visible in the 2003 BOR inspection nor was it visible during our inspection. The stream has apparently recovered the siphon with alluvial deposits since the 2002 inspection. Stream erosion, failure of the upstream dike system and subsequent channel migration pose the largest threats to the canal system at this location.

Figure 4.3.2 Kennedy Creek side of inlet structure (11/11/04).

Outlet Transition Structure and Headwall.

The outlet of the siphon is in similarly poor condition as the inlet. The beam at the top of the retaining wall at the siphon exit is in poor condition with a large amount of spalling and reinforcing steel exposed (Figure 4.3.3). The retaining walls appear to have been extended since the original construction based on the appearance of joints and types of exposed rebar.

Figure 4.3.3 Kennedy Creek side of outlet structure (11/11/04).

Operation and Safety

The inlet transition structure has had fencing placed part way around it, but does not extend down to the water line nor does it extend upstream to the safety boom. The fence should be extended for improved safety.

4.3.3 Rehabilitation Alternatives

The headwalls on either end of the siphon have some severe cracks with exposed reinforcing steel. The concrete inlet and outlet sections have deteriorated concrete at the winter water line. In general, this structure appears to be repairable. However, the cost difference of a replacement structure and the ability to perform summer construction make structure replacement the prudent alternative. Also, the hydraulic capacity of this siphon needs to be analyzed to determine if it is compatible with the various proposed design flows for the canal (>850 cfs). If inadequate, a parallel and larger replacement siphon is definitely warranted.

The siphon also needs to be reviewed with respect to Kennedy Creek. The top of the siphon was exposed in the creek bed a couple years ago. The stream deposition has since apparently recovered it. A general review of the creek channel width at the siphon, siphon depth, and upstream training dikes is recommended. If a new siphon were required, it may be advisable to adjust the length and depth of the siphon for added protection. A means of draining the siphon is also desirable to facilitate periodic inspection and maintenance of the facility.

Presently, Kennedy Creek is a barrier with respect to maintenance vehicles. In our opinion, it may be possible to construct a low water crossing using low-profile gabions which would permit maintenance vehicle access across Kennedy Creek. This system could be designed and incorporated to also provide protection against erosion and scour of the buried replacement siphon.

4.3.4 Estimated Rehabilitation Costs

In March 2003, the BOR estimated rehabilitation costs would vary from $700,000 to $1,250,000. For budgeting purposes, these costs should be updated and projected to a future anticipated construction season. We have assumed a construction season of 2007 and an inflation of 3%

(1.1255 factor). The BOR cost estimates include "non-contract costs" of 37% but do not include 5% for Tribal fees.

The following table lists the original BOR cost estimates and the projected 2007 costs.

Table 4.3.1 Cost Estimates to Rehabilitate Kennedy Creek Siphon

Canal Capacity	BOR Cost Estimates - 2003		Projected Costs - 2007[1]	
	Repair Existing	Replacement	Repair Existing	Replacement
500 cfs	$820,000	$700,000	$969,100	$827,300
670 cfs	$880,000	$800,000	$1,040,000	$945,500
850 cfs	$930,000	$950,000	$1,099,100	$1,122,700
1000 cfs	$1,000,000	$1,250,000	$1,181,800	$1,477,200

(1) = [(BOR Costs) * 1.1255] * 1.05

4.3.5 Rehabilitation Schedule

The existing siphon is in marginal condition and some repair work is warranted. This work can be delayed for a few years if necessary, although some immediate repair work may help preserve the structure if it is to be rehabilitated and utilized as part of the future system. Some safety improvements should be implemented soon. These include extension of fencing around the inlet and outlet. Replacement may be required in order to increase capacity consistent with the Preferred Alternative. This will ultimately control whether the structure is repaired or replaced.

Once an overall Preferred Alternative is selected, designs for the siphon can be completed within four months. Construction may take 12 to 14 months, depending on environmental restrictions associated with wildlife and Kennedy Creek (Table 4.3.2).

Table 4.3.2 Estimated Time to Rehabilitate the Kennedy Creek Siphon

Task	Duration
1) Feasibility Study	1.5 months
2) Final Design	2.5 months
3) Construction Phase	12-14 months
TOTAL TIME	16-18 months